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Effect of Fungicides and Plant Populations on Soybean Disease and Yield

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Abstract
Applications of foliar fungicides on soybean have been shown to reduce disease pressure and protect yield under the right conditions, especially in environments that have very wet or humid conditions. In the past decade, fungicide use in Iowa has increased. Initially, growers were concerned with the potential threat of soybean rust, which is controlled effectively by foliar fungicides. In Iowa, however, there has not been any case of yield reduction due to soybean rust. New potential purposes for foliar fungicides include "plant health" benefits and the reduction of foliar diseases endemic in Iowa such as Septoria brown spot, Cercospora leaf blight, and frogeye leaf spot. Currently what is not known is how the efficacy of fungicides is affected when agricultural practices change. Our question: How does plant population affect the efficacy of fungicides?

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Disciplines
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RFR-A10100

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Introduction

Applications of foliar fungicides on soybean have been shown to reduce disease pressure and protect yield under the right conditions, especially in environments that have very wet or humid conditions. In the past decade, fungicide use in Iowa has increased. Initially, growers were concerned with the potential threat of soybean rust, which is controlled effectively by foliar fungicides. In Iowa, however, there has not been any case of yield reduction due to soybean rust. New potential purposes for foliar fungicides include "plant health" benefits and the reduction of foliar diseases endemic in Iowa such as Septoria brown spot, Cercospora leaf blight, and frogeye leaf spot. Currently what is not known is how the efficacy of fungicides is affected when agricultural practices change. Our question: How does plant population affect the efficacy of fungicides?

Materials and Methods

Soybean fungicide trials were set up in 2007, 2008, 2009, and 2010 at the ISU Northeast Research Farm.

There were two treatment levels in this study: plant population and fungicide application. Soybeans were planted at 80,000, 128,000, 175,000 and 225,000 seeds/acre. Half of these plots were sprayed with pyraclostrobin (Headline®, BASF) at growth stage R3 (Table 1) and the other half were used as non-treated controls.

Disease severity was assessed late in season (growth stage R5-R6) by visually estimating percent lesion area on 10 leaflets in the upper and lower canopy or each plot. Diseases assessed included Septoria brown spot, Cercospora leaf blight and frogeye leaf spot. Brown spot was primarily found in the lower canopy. Cercospora leaf blight and frogeye leaf spot were found in the upper canopy, and due to low levels in all years, these ratings were combined as total disease in the upper canopy.

After senescence, final plant population was determined, soybeans were harvested and yields were standardized to bushels/acre at 13 percent moisture for comparison.

Results and Discussion

Fungicides effectively reduced brown spot in most years, even at most plant populations. In 2010 brown spot severity was highest compared with previous years (Table 1).

Although Headline® reduced disease severity (Table 1), there were few instances where Headline®-treated plots yielded statistically higher than the non-treated equivalent. Three plant populations in 2009 and one in 2010 had significantly higher yields in plots treated with Headline®.

Results in each year of this study resulted in some fairly unique results, despite experimental design and location staying the same. This is a good illustration of how each growing season brings a different set of challenges than the previous one. In most cases fungicides were able to decrease the severity of brown spot at any plant population level, though it did not always result in statistically higher yields. Fungicides at all plant populations, in most cases, would not have been economical.

Table 1. The effect of fungicide and plant population on Septoria brown spot and yield in northeast Iowa in 2007–2010.

		2007		2008		2009		2010	
Fungicide treatment	Initial plant population	Brown spot[a]	Yield (bu/a)	Brown spot[a]	Yield (bu/a)	Brown spot[a]	Yield (bu/a)	Brown spot[a]	Yield (bu/a)
Headline	80,000	1.7	62.5	3.7	58.7	4.5	60.9*	2.5*	60.4
Headline	128,000	2.3	61.7	2.9	61.6	3.6*	63.9*	5.1*	63.3*
Headline	175,000	2.7	63.3	3.1	61.5	7.3*	64.6*	5.3*	59.7
Headline	225,000	3.0	60.3	3.8	61.4	6.8	64.1	4.5*	60.9
Average		2.4	62.0	3.4	60.8	5.6	63.4	4.4	61.1
None	80,000	4.0	57.4	2.9	59.2	10.9	57.5	10.1	57.4
None	128,000	3.7	59.7	2.7	61.3	13.1	59.3	11.7	57.2
None	175,000	4.3	56.7	5.2	62.0	15.4	61.2	18.7	59.0
None	225,000	5.0	56.7	6.2	62.5	9.4	62.6	12.2	60.7
Average		4.3	57.6	4.3	61.3	12.2	60.2	13.2	58.6

[a]Brown spot severity was assessed on 10 leaves in the lower canopy. Values are a percentage of leaf area affected by brown spot.

*Statistical differences between the treated and non-treated equivalent ($P \leq 0.05$).